ENVIRONMENTAL SENSITIVITY INDEX: ALABAMA

INTRODUCTION

Environmental Sensitivity Index (ESI) maps have been developed for the shoreline of Alabama to encompass the coastal areas including Mississippi Sound, Mobile Bay, Mobile River Delta, and Perdido Bay. The ESI maps include information for three main components: shoreline habitats; sensitive biological resources; and human-use resources. The methods of data collection and presentation are summarized in the following sections.

SHORELINE HABITAT MAPPING

The shoreline habitats of Alabama were characterized as to their sensitivity to oil spills using a shoreline classification system which has been used by the National Oceanic and Atmospheric Administration (NOAA) for all ESI maps nationwide. Prediction of the behavior and persistence of oil on intertidal habitats is based on an understanding of the dynamics of the coastal environments, not just the substrate type and grain size. The sensitivity of a particular habitat is an integration of the following factors:

1) Shoreline type (substrate, grain size, tidal elevation, origin)

2) Exposure to wave and tidal energy

3) Biological productivity and sensitivity

4) Ease of cleanup

All of these factors are used to determine the relative sensitivity of intertidal habitats. Key to the sensitivity ranking is an understanding of the relationships between: physical processes, substrate, shoreline type, product type, fate and effect, and sediment transport patterns. The intensity of energy expended upon a shoreline by wave action, tidal currents, and river currents directly affects the persistence of stranded oil. The need for shoreline cleanup activities is determined, in part, by the slowness of natural processes in removal of oil stranded on the shoreline.

These concepts have been used in the development of the ESI, which ranks shoreline environments as to their relative sensitivity to oil spills, potential biological injury, and ease of cleanup. Generally speaking, areas exposed to high levels of physical energy, such as wave action and tidal currents, and low biological activity rank low on the scale, whereas sheltered areas with associated high biological activity have the highest ranking. The list below includes the shoreline habitats delineated for Alabama, presented in order of increasing sensitivity to spilled oil.

1) Exposed Walls and Other Solid Structures Made of Concrete, Wood, or Metal

2A) Scarps and Steep Slopes in Clay (Not Present in Study Area)

2B) Wave-cut Clay Platforms (Not Present in Study Area)

3A) Fine-grained Sand Beaches

3B) Scarps and Steep Slopes in Sand

4) Coarse-grained Sand Beaches (Not Present in Study Area)

5) Mixed Sand and Gravel (Shell) Beaches

6A) Gravel (Shell) Beaches (Not Present in Study Area)

6B) Exposed Riprap Structures

7) Exposed Tidal Flats

8A) Sheltered Solid Man-made Structures

8B) Sheltered Riprap Structures

8C) Sheltered Scarps

9A) Sheltered Tidal Flats

9B) Riverine Banks with Grasses or Trees

10A) Salt and Brackish Water Marshes

10B) Freshwater Marshes (Herbaceous Vegetation)

10C) Freshwater Swamps (Woody Vegetation)

The shoreline habitats of Alabama were initially mapped on paper copies of U.S. Geological Survey (USGS) topographic quadrangles (1:24,000) using a combination of aerial photographs taken between 1985 and 1987, low-altitude color video surveys taken in 1992 and 1993, and local knowledge by geologists from the Geological Survey of Alabama (GSA). Where appropriate, multiple habitats were delineated for each shoreline segment. The maps were then field checked during overflights on 10-11 October 1995 by coastal geologists from Research Planning, Inc. (RPI) and GSA. Significant changes in the position of the shoreline were noted on the maps during the overflights. The changed shoreline positions and the ESI classification were digitized using the shoreline derived from the USGS Digital Line Graph files.

Each of the shoreline habitats is described on pages 6-12, in terms of their physical description, predicted oil behavior, and response considerations. Summary statistics are given for each shoreline habitat, in terms of the percent of the total shoreline length as mapped along the Alabama coast. These statistics were calculated by summing the shoreline lengths for each habitat type, double counting the segments where more than one shoreline type was mapped. Therefore, even though the length of actual shoreline mapped, which includes bays and the lower parts of rivers, was determined to be 2,455 kilometers, the sum of all classified shorelines was 2,753 kilometers.

SENSITIVE BIOLOGICAL RESOURCES

Biological information was compiled from various state and federal sources, including the Alabama Department of Conservation and Natural Resources, Alabama Natural Heritage State Lands Division, Dauphin Island Sea Lab, U.S. National Biological Service, and the U.S. Fish and Wildlife Service. Information collected and depicted on the maps denotes the key biological resources that are most likely at risk in the event of an oil spill. Six major categories of biological resources were researched during production of the maps: birds, fish, habitats, reptiles, terrestrial mammals, and shellfish.

Spatial distribution of the species on the maps is represented by polygons, lines, and points, as appropriate. Associated with each of these representations is an icon depicting the types of habitats or animals that are present. Species have been divided into groups and subgroups, based on their behavior and taxonomic classification. The icons reflect this grouping scheme. The groups are color coded, and the subgroups are represented by different icons as follows:

TERRESTRIAL MAMMALS

- Small Mammals

BIRDS

- Alcid / Pelagic Birds
- Diving Birds
- Gulls and Terns
- Raptors
- Shorebirds
- Wading Birds
- Waterfowl

REPTILES

- Alligators
- Snakes
- Turtles

FISH

- Fish

SHELLFISH

- Crabs
- Oysters
- Shrimp

HABITATS

- Plants
- Submerged Aquatic Vegetation

The polygon, line, or point color and pattern are the same for all the animals in one group. When there is more than one group of animals in one polygon, the polygon is then assigned the multi-group color and pattern (black hatch polygon). Also associated with each polygon on the map is a number (located under the icon for the polygon). This number references a table on the reverse side of the map with a complete list of species found in the polygon as well as life-history information on each species present.

There are some species that are found throughout the nearshore zone on the map. While it is important to note the presence of these species, showing these distributions as polygons would cover large areas, making the maps very difficult to read. Thus, species which have an area greater than 25 percent of the water area are identified in a box stating that they are “COMMON IN AREA”. This approach informs the user of the presence of these species, while maintaining readability of the map.

TERRESTRIAL MAMMALS

Both marine and terrestrial mammals were considered for inclusion on the ESI maps. The predominate species of marine mammal in the Alabama coastal area is the bottlenose dolphin. They are present throughout state waters with no particular areas of concentration. In order to keep the maps more readable, dolphins were not included. It is important to realize that dolphins are present everywhere along the coast and are an important resource to consider during planning and spill response.

Terrestrial mammals shown on the maps include beaver, mink, muskrat, northern raccoon, nutria, river otter, Alabama beach mouse, and Perdido Key beach mouse. Only the critical habitats for the Alabama beach mouse are shown. However, it is present along all the beaches from Fort Morgan to Perdido Bay. Terrestrial mammal concentration areas are shown by a brown hatch polygon. However, if species in addition to terrestrial mammals are included in the polygon, a black hatch (multigroup) polygon is used. A brown icon associated with the polygon has a silhouette indicating terrestrial mammals. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated as endangered (E) and / or threatened (T) status on the state (S) and / or federal (F) lists. The Perdido Key beach mouse and Alabama beach mouse are both

federally endangered species. The next column provides an estimate of the concentration of species at this site. Concentration is indicated as "MED" for all terrestrial mammals. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column.

BIRDS

Birds are divided into several species subgroups based on behavior and taxonomy. The species table lists all the birds included on the maps, sorted by subgroup. These species were included either because of their likelihood of impact by an oil spill or special protection status as threatened or endangered. Bird distribution is shown on the maps as points and polygons. Green dots on the maps depict known nesting sites. Bird concentrations are shown as a green hatch polygon; however, if species in addition to birds are in the polygon, a black hatch (multigroup) polygon is used. Green icons with a silhouette identifying which bird subgroup is present are associated with each point or polygon. If one or more species in a subgroup are threatened or endangered, a red box appears around the icon. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name, followed by the state (S) and/or federal (F) species designation for endangered (E) or threatened (T) status. The next column provides an estimate of the concentration of species at this site. Concentration is indicated as "HIGH", "MED", or "LOW" for polygon areas and numbers of nests for bird nesting sites. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. The last four columns denote the times for nesting, laying, hatching, and fledging at this site.

REPTILES

Reptile species shown on the maps include the American alligator, Gulf salt marsh snake, Alabama red-bellied turtle, Loggerhead sea turtle, and the Mississippi diamondback terrapin. Although the loggerhead, leatherback, and Kemp's ridley sea turtle are present throughout the coastal waters of Alabama, site-specific information is only available for the loggerhead sea turtle. There are no known water concentration areas, thus only nesting beaches are shown. For other species, concentration areas are shown where known. Alligators are present throughout all wetland areas and are depicted on the Grand Bay maps.

Reptile concentration areas are shown as polygons with a red hatch pattern. If species in addition to reptiles are present in the polygons, a black hatch (multigroup) pattern is used. Red icons are associated with the polygons, and a silhouette of a reptile is shown. In addition, a red box appears around the icon indicating the species is threatened. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. The loggerhead sea turtle is federally threatened and the Alabama red-bellied turtle is federally endangered. The next column provides an estimate of the concentration of species at this site. Concentrations of reptiles are indicated as "MED". These estimates are subjective based on local expert opinion on the relative concentrations in the area. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. The next-to-last column indicates the most likely dates for egg laying by loggerhead sea turtles. The last column indicates when the young hatch and escape to the Gulf.

FISH

Fish distributions shown on the map represent spawning areas, areas of particularly high concentrations of selected species, and anadromous streams. The species shown are only those of commercial and/or recreational value, those considered important prey species, or threatened or endangered species. There are over 200 additional species known to exist in Alabama coastal waters. Distribution and concentrations of the fish are based primarily on trawl surveys conducted throughout the coastal waters of Alabama. The species table lists all the fish included on the maps. Concentration or spawning areas for fish are shown as polygons on the maps. Fish polygons are shown as a blue hatch pattern; however, if species in addition to fish are in the polygon, a black hatch (multigroup) pattern is used. Blue icons are associated with the polygons. If the polygon includes Gulf sturgeon, the only threatened fish species, a red box appears around the icon. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. The next column provides an estimate of the concentration of species at this site. Concentrations of fish are indicated as "MED". These estimates are subjective based on local expert opinion on the relative concentrations in the area. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. The last two columns denote normal times for spawning (all fish) and outmigration (anadromous fish).

SHELLFISH

Shellfish have been divided into three subgroups: shrimp (brown, pink, and white), crabs (blue), and oysters (American). The species table lists all the shellfish shown on the maps, sorted by subgroup. Species that are commercially or recreationally important are included. The distribution of shellfish is shown as polygons with an orange hatch pattern. If species in addition to shellfish are included in the polygon, a black hatch (multigroup) pattern is used. Orange icons are associated with the polygons, and the silhouette of the subgroup is shown. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. No shellfish on the maps have such designations. The next column provides an estimate of the concentration of species at this site. Concentrations are indicated as "HIGH" or "MED". These estimates are based on extensive trawl data and surveys of Alabama's oyster reefs. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. The last columns indicates dates for spawning and juvenile concentrations.

HABITATS

The only habitats shown on the maps are submerged aquatic vegetation (SAV), the American chaffseed, and Alabama cane-brake pitcher (both of which are federally endangered). The SAV beds of coastal Alabama and Mobile Bay, excluding Mobile River and Delta, were mapped from aerial photographs taken by the National Biological Service (NBS) in 1992. The Alabama Department of Conservation and Natural Resources (ADCNR), Game and Fish Division, mapped the SAV beds of the lower Mobile River and Delta from aerial photos taken in 1994. This information was supplemented with personal knowledge from Judy Stout of Dauphin Island Sea Lab. The emergent vegetation, such as marshes and swamps, are considered a shoreline classification and are not addressed in this section. The SAV beds and terrestrial plants are shown as polygons with a purple hatch pattern. If species in addition to plants are present in the polygons, a black hatch (multigroup) pattern is used. Purple icons are associated with the polygons, and the seagrass silhouette is shown. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. No seagrasses have such designation. The next column provides an estimate of the concentration of species at this site. Concentration is indicated using NBS's scheme of "CONTINUOUS", "DENSE", "MODERATE", "SPARSE", or "VERY SPARSE" for salt water SAV. Freshwater SAV uses the scheme developed by DCNR of "ABUNDANT", "COMMON", "SLIGHT", or "SCARCE". The last twelve columns provide information on seasonality. All 12 months are marked with an 'X' since the plants are present all year.

HUMAN-USE FEATURES

Human-use information was compiled from various state and federal sources, including the Alabama Historical Commission and the Alabama Department of Environmental Management. The human-use features depicted on the maps are those that either could be impacted by an oil spill or could provide access for the cleanup operation. All the features are represented by icons indicating the type of feature. If the icon is not placed on the location of the feature, a leader line is drawn from the icon to the proper location.

General locations for some archaeological sites are indicated on the map. Only the sites that might be impacted directly by a marine spill, or the associated cleanup activities, are shown. Sites were determined to be potentially impacted if they were located in wetlands, on the shoreline, or between an access road and the shoreline. The icons on the map are an approximate location (within 0.5 miles) of the site. If there is an incident that will impact in the vicinity of an archaeological or historical site, the Alabama Historical Commission must be contacted at 205/371-2266. This office can advise on how to proceed with regard to the archaeological site.

Airport—Location of airfields or airports whether they are manned or unmanned. The locations were obtained from visual observations during the overflights or from U.S. Geological Survey (USGS) topographic maps.

Archaeological site—Location of known archaeological sites in close proximity to the shoreline. This information was provided by the Alabama Historical Commission

Boat ramp—Location of boat ramps. This information was obtained from the Alabama Department of Environmental Management and overflight observations.

Historical site—Location of known historical sites in close proximity to the shoreline. This data information was provided by the Alabama Historical Commission.

Marina—Location of any marinas. This information was provided by the Alabama Department of Environmental Management and overflight observations.

State park—An icon is used to show the location of the state park.

Reserve, preserve, or refuge—All boundaries for the reserves, preserves, refuges, or any other managed and regulated wildlife area were provided by USFWS. The boundary is shown on the map with an icon and the name along the boundary.

Water Intakes—Location of water intakes. This information was provided by the Alabama Department of Environmental Management and overflight observations.

GEOGRAPHIC INFORMATION SYSTEM DATA

The entire atlas product is stored in digital form in a Geographic Information System (GIS). The information is stored as geographic layers and associated databases. The format for the data varies depending on the type of information or features for which the data are being stored. The three major formats are shoreline habitat classification, biological resources, and human-use features.

Under separate cover is a metadata document which details the data dictionary, processing techniques, and descriptive information for the digital data sets and maps that were used to create this atlas. Below is a brief synopsis of the information contained in the digital version. Refer to the metadata file for a full explanation of the data and its structure.

SHORELINE HABITAT CLASSIFICATION

The shoreline habitat classification is stored as lines and polygons with the data identifying the type of habitat. In many cases, a shoreline may have two or three different classifications. These multiple classifications are represented on the maps by double and triple lines, and in the database by ESI#1/ESI#2 where ESI#1 is the landward-most classification and ESI#2 is the seaward-most classification. The habitat polygons represent sensitive wetlands with a single attribute.

SENSITIVE BIOLOGICAL RESOURCES

Biological resources are stored as lines, points, or polygons. Associated with each feature is a unique identification number which is linked to a series of databases that further identify the resources. The first data set consists of a list of the species and the concentration of each species. This dataset is then linked to a dataset that describes the life history of each species (temporal presence and reproductive/lifehistory time periods at month resolution) for the specified map feature. Other databases linked to the first data set are the species identification database, which includes common and scientific names for all species and their threatened or endangered status, and the sources database, which provides source metadata at the feature level.

HUMAN-USE FEATURES

Human-use features are represented as points, lines, and polygons (managed lands). All metadata sources are documented at the feature level.

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At Research Planning, Inc. (RPI), Jacqueline Michel and Jeffrey Dahlin were the project scientists. Todd M. Montello participated in the field verification of the shoreline classification. James Olsen entered the data and produced the final maps under the supervision of Joanne Halls. Graphics were provided by Joe Holmes, and Dot Zaino prepared the text.

SPECIES LIST*

Common Name	Species Name
TERRESTRIAL MAMMALS	
SMALL MAMMALS	
Alabama beach mouse	*Peromyscus polionotus ammobates*
Beaver	*Castor canadensis*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Northern raccoon	*Procyon lotor*
Nutria	*Myocastor coypus*
Perdido Key beach mouse	*Peromyscus polionotus trissyllepsis*
River otter	*Lutra canadensis*
BIRDS	
ALCIDS	
Black guillemot	*Cepphus grylle*
DIVING BIRDS	
American white pelican	*Pelecanus erythrorhynchos*
Anhinga	*Anhinga anhinga*
Brown pelican	*Pelecanus occidentalis*
Common loon	*Gavia immer*
Double-crested cormorant	*Phalacrocorax auritus*
Horned grebe	*Podiceps auritus*
Pied-billed grebe	*Podilymbus podiceps*
Red-throated loon	*Gavia stellata*
GULLS AND TERNS	
Black skimmer	*Rynchops niger*
Black tern	*Chlidonias niger*
Bonaparte's gull	*Larus philadelphia*
Caspian tern	*Sterna caspia*
Common tern	*Sterna hirundo*
Forster's tern	*Sterna fosteri*
Gull-billed tern	*Sterna nilotica*
Herring gull	*Larus argentatus*
Laughing gull	*Larus atricilla*
Least tern	*Sterna antillarum*
Ring-billed gull	*Larus delawarensis*
Royal tern	*Sterna maxima*
Sandwich tern	*Sterna sandvicensis*
Sooty tern	*Sterna fuscata*
PELAGIC BIRDS	
Blue-faced booby (masked)	*Sula dactylatra*
Magnificent frigatebird	*Fregata magnificens*
Northern gannet	*Morus bassanus*
RAPTORS	
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Osprey	*Pandion haliaetus*
SHOREBIRDS	
American oystercatcher	*Haematopus palliatus*
Black-bellied plover	*Pluvialis squatarola*
Dowitcher	*Limnodromus spp.*
Dunlin	*Calidris alpina*
Greater yellowlegs	*Tringa melanaleuca*
Killdeer	*Charadrius vociferus*
Least sandpiper	*Calidris minutilla*
Lesser yellowlegs	*Tringa flavipes*
Long-billed curlew	*Numenius americanus*
Marbled godwit	*Limosa fedoa*
Pectoral sandpiper	*Calidris melanotos*
Piping plover	*Charadrius melodus*
Red knot	*Calidris canutus*
Ruddy turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Semipalmated plover	*Charadrius semipalmatus*
Semipalmated sandpiper	*Calidris pusilla*
Short-billed dowitcher	*Limnodromus griseus*
Snowy plover	*Charadrius alexandrinus*
Solitary sandpiper	*Tringa solitaria*
Spotted sandpiper	*Actitis macularia*
Stilt sandpiper	*Calidris himantopus*
Western sandpiper	*Calidris mauri*
Whimbrel	*Numenius phaeopus*
White-rumped sandpiper	*Calidris fusciollis*
Willet	*Catoptrophorus semipalmatus*
Wilson's plover	*Charadrius wilsonia*
WADING BIRDS	
American avocet	*Recurvirostra americana*
American bittern	*Botaurus lentiginosus*
Black rail	*Laterallus jamaicensis*
Black-crowned night heron	*Nycticorax nycticorax*
Black-necked stilt	*Himantopus mexicanus*

SPECIES LIST*

Common Name	Species Name
BIRDS (continued)	
WADING BIRDS (continued)	
Cattle egret	*Bubulcus ibis*
Clapper rail	*Rallus longirostris*
Glossy ibis	*Plegadis falcinellus*
Great blue heron	*Ardea herodias*
Great egret	*Casmerodius albus*
Green-backed heron	*Butorides striatus*
King rail	*Rallus elegans*
Least bittern	*Ixobrychus exilis*
Little blue heron	*Egretta caerulea*
Reddish egret	*Egretta rufescens*
Sandhill crane	*Grus canadensis*
Snowy egret	*Egretta thula*
Sora rail	*Porzana carolina*
Tricolored heron	*Egretta tricolor*
White ibis	*Eudocimus albus*
Yellow-crowned night heron	*Nyctanassa violacea*
WATERFOWL	
American coot	*Fulica americana*
American wigeon	*Anas americana*
Black duck	*Anas rubripes*
Black scoter (common)	*Melanitta nigra*
Blue-winged teal	*Anas discors*
Bufflehead	*Bucephala albeola*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Common goldeneye	*Bucephala clangula*
Common moorhen	*Gallinula chloropus*
Greater scaup	*Aythya marila*
Green-winged teal	*Anas crecca*
Hooded merganser	*Lophodytes cucullatus*
Lesser scaup	*Aythya affinis*
Mallard	*Anas platyrhynchos*
Mottled duck	*Anas fulrigula*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Oldsquaw	*Clangula hyemalis*
Purple gallinule	*Porphyrula martinica*
Red-breasted merganser	*Mergus serrator*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Ruddy duck	*Oxyura jamaicensis*
Snow goose	*Chen caerulescens*
Surf scoter	*Melanitta perspicillata*
White-winged scoter	*Melanitta deglandi*
Wood duck	*Aix sponsa*
REPTILES	
Alabama red-bellied turtle	*Pseudemys alabamensis*
American alligator	*Alligator mississippiensis*
Gulf salt marsh snake	*Nerodia clarkii*
Loggerhead sea turtle	*Caretta caretta*
Mississippi diamondback terrapin	*Malaclemys terrapin pileata*
FISH	
ANADROMOUS	
Atlantic sturgeon	*Acipenser oxyrhynchus*
Gulf sturgeon	*Acipenser oxyrhynchus desotoi*
Skipjack herring	*Alosa chrysochloris*
Striped bass	*Morone saxatilis*
REEF FISH	
Butterfly fish	*Chaetodon sp.*
Surgeon fish	*Acanthurus sp.*
SPECIAL CONCENTRATIONS	
American eel	*Anguilla rostrata*
Atlantic croaker	*Micropogonias undulatus*
Atlantic spadefish	*Chaetodipterus faber*
Atlantic thread herring	*Opisthonema oglinum*
Bay anchovy	*Anchoa mitchilli*
Black crappie	*Pomoxis nigromaculatus*
Black drum	*Pogonias cromis*
Blacktip shark	*Carcharhinus limbatus*
Blue catfish	*Ictalurus furcatus*
Blue runner	*Caranx crysos*
Bluefish	*Pomatomus saltatrix*
Bluegill	*Lepomis macrochirus*
Bonnethead shark	*Sphyrna tiburo*
Broad flounder	*Paralichthys squamilentus*
Brown bullhead	*Ictalurus nebulosus*
Chain pickerel	*Esox niger*

* Threatened and endangered species are designated by underlining.

SPECIES LIST*

Common Name	Species Name
FISH (continued)	
SPECIAL CONCENTRATIONS (continued)	
Channel catfish	*Ictalurus punctatus*
Cobia	*Rachycentron canadum*
Crevalle jack	*Caranx hippos*
Diamond killifish	*Adenia xenica*
Dolphin	*Coryphaena hippurus*
Finetooth shark	*Carcharhinus isodon*
Florida pompano	*Trachinotus carolinus*
Gafftopsail catfish	*Bagre marinus*
Gag grouper	*Mycteroperca microlepis*
Gizzard shad	*Dorosoma cepedianum*
Grass pickeral	*Esox americanus*
Gray snapper	*Lutjanus griseus*
Great barracuda	*Sphyraena barracuda*
Gulf butterfish	*Peprilus burti*
Gulf flounder	*Paralichthys albigutta*
Gulf killifish	*Fundulus grandis*
Gulf kingfish	*Menticirrhus littoralis*
Gulf menhaden	*Brevoortia patronus*
Halfbeak	*Hyporhamphus unifasciatus*
Hardhead catfish	*Arius felis*
Harvestfish	*Peprilus alepidotus*
Inland silverside	*Menidia beryllina*
King mackerel	*Scomberomorus cavalla*
Ladyfish	*Elops saurus*
Lane snapper	*Lutjanus synagris*
Largemouth bass	*Micropterus salmoides*
Little tunny	*Euthynnus alletteratus*
Longear sunfish	*Lepomis megalotis*
Longnose killifish	*Fundulus similis*
Marsh killifish	*Fundulus confluentus*
Northern kingfish	*Menticirrhus saxatilis*
Paddlefish	*Polyodon spathula*
Peamouth	*Mylocheilus caurinus*
Pigfish	*Orthopristis chrysoptera*
Pinfish	*Lagodon rhomboides*
Rainwater killifish	*Lucania parva*
Red drum	*Sciaenops ocellatus*
Red snapper	*Lutjanus campechanus*
Redear sunfish	*Lepomis microlophus*
Rough scad	*Trachurus lathami*
Rough silverside	*Membras martinica*
Sailfin molly	*Poecilia latipinnaa*
Saltmarsh topminnow	*Fundulus jenkinsi*
Sand seatrout	*Cynoscion arenarius*
Scaled sardine	*Harengula jaguana*
Sheepshead	*Archosargus probatocephalus*
Sheepshead minnow	*Cyprinodon variegatus*
Shiners	*Notropis spp.*
Silver perch	*Bairdiella chrysoura*
Silver seatrout	*Cynoscion nothus*
Southern flounder	*Paralichthys lethostigma*
Southern hake	*Urophycis floridanus*
Southern kingfish (whiting)	*Menticirrhus americanus*
Spanish mackerel	*Scomberomorus maculatus*
Spanish sardine	*Sardinella aurita*
Spot	*Leiostomus xanthurus*
Spotfin mojarra	*Eucinostomus argenteus*
Spotted hake	*Urophycis regius*
Spotted seatrout	*Cynoscion nebulosus*
Spotted sunfish	*Lepomis punctatus miniatus*
Star drum	*Stellifer lanceolatus*
Striped anchovy	*Anchoa hepsetus*
Striped mullet	*Mugil cephalus*
Tarpon	*Megalops atlanticus*
Threadfin shad	*Dorosoma petenense*
Tripletail	*Lobotes surinamensis*
White mullet	*Mugil curema*
Yellow bass	*Morone mississippiensis*

SPECIES LIST*

Common Name	Species Name
SHELLFISH	
CRAB	
Blue crab	*Callinectes sapidus*
OYSTER	
American oyster (eastern)	*Crassostrea virginica*
SHRIMP	
Brown shrimp	*Penaeus aztecus*
Pink shrimp	*Penaeus duorarum*
White shrimp	*Penaeus setiferus*
HABITATS	
PLANTS	
Alabama canebrake pitcher	*Sarracenia rubra ssp. alabamensis*
American chaffseed	*Schwalbea americana*
SUBMERGED AQUATIC VEGETATION	
American chaffseed	*Schwalbea americana*
Coontail	*Ceratophyllum demersum*
Egeria	*Egeria densa*
Eurasian water-milfoil	*Myriophyllum spicatum*
Hydrilla	*Hydrilla verticillata*
Pondweed	*Potamogeton sp.*
Seagrass	
Shoal grass	*Halodule wrightii*
Southern naiad	*Najas sp.*
Water celery	*Vallisneria americana*
Water stargrass	*Hereranthera dubia*
Widgeon grass	*Ruppia maritima*

* Threatened and endangered species are designated by underlining.

EXPOSED WALLS AND OTHER SOLID STRUCTURES
MADE OF CONCRETE, WOOD, OR METAL ESI = 1

DESCRIPTION

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- Many structures are constructed of concrete, wood, or metal.
- Often there is no exposed beach at low tide, but multiple habitats are indicated if present.
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- They are heavily utilized by the public for shoreline-based fishing.
- Attached animals and plants are sparse.
- They are not common, comprising about 5 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil is often held offshore by waves reflecting off the steep structures.
- Any oil that is deposited is rapidly removed from exposed faces.
- The most resistant oil would remain as a patchy band at or above the high-tide line.

RESPONSE CONSIDERATIONS

- Cleanup is usually not required.
- Access can be difficult and dangerous.
- High-pressure water spraying may be required to:
  - remove persistent oil;
  - improve aesthetics; or
  - prevent leaching of oil from the structure.

SCARPS AND STEEP SLOPES IN CLAY ESI = 2A

NOT PRESENT IN STUDY AREA

WAVE-CUT CLAY PLATFORMS ESI = 2B

NOT PRESENT IN STUDY AREA

FINE-GRAINED SAND BEACHES ESI = 3A

DESCRIPTION

- These beaches are generally flat and hard-packed.
- Though they are predominately fine sand, there is often a small amount of shell or shell hash.
- There can be heavy accumulations of wrack present.
- They occur along most of the Gulf coast and island shorelines.
- They undergo gradual erosion / deposition cycles.
- They are heavily utilized by birds for nesting, foraging, and loafing.
- Upper beach fauna include ghost crabs and amphipods; lower beach fauna can be dense, but are highly variable.
- Fine-grained sand beaches are common, comprising 13 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Light oil accumulations will be deposited as oily swashes or bands along the upper intertidal zone.
- Heavy oil accumulations will cover the entire beach surface; oil will be lifted off the lower beach with the rising tide.
- Maximum penetration of oil into fine-grained sand is about 10 cm.
- Burial of oiled layers by clean sand within the first few weeks after a spill typically will be less than 30 cm along the upper beach face.
- Organisms living in the beach may be killed by smothering or lethal oil concentrations in the interstitial water.
- Biological impacts include temporary declines in infaunal populations, which can also affect important shorebird foraging areas.

RESPONSE CONSIDERATIONS

- These beaches are among the easiest shoreline types to clean.
- Cleanup should concentrate on removing oil and oily debris from the upper swash zone once oil has come ashore.
- Activity through both oiled and dune areas should be severely limited, to prevent contamination of clean areas.
- Manual cleanup, rather than road graders and front-end loaders, is advised to minimize the volume of sand removed from the shore and requiring disposal.
- All efforts should focus on preventing the mixture of oil deeper into the sediments by vehicular and foot traffic.
- Mechanical reworking of lightly oiled sediments from the high-tide zone to the upper intertidal zone can be effective along the Gulf shore.

SCARPS AND STEEP SLOPES IN SAND ESI = 3B

DESCRIPTION

- This shoreline type occurs where sandy bluffs are undercut by waves and slump.
- They normally form along embankments of sandy dredge-spoil material and at cutbanks in rivers.
- Some scarps are fronted by narrow beaches, if the erosion rate is moderate or episodic.
- Biological utilization by infauna and birds is low.
- They are not common in the study area, comprising 2 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil will concentrate at the high water line, with the potential for penetration up to 10 cm into the sandy sediments.
- There is little potential for burial except when a major slumping of the bluff occurs.
- Burial of oiled layers by clean sand within the first few weeks typically will be less than 30 cm along the upper beach face.

RESPONSE CONSIDERATIONS

- Cleanup should concentrate on the removal of oil from the upper swash zone after all oil has come ashore.
- Manual cleanup is advised to minimize the volume of sand removed from the shore and requiring disposal, and reduce the risk of increased slumping and bluff erosion.
- All efforts should focus on preventing the mixture of oil deeper into the sediments.

COARSE-GRAINED SAND BEACHES ESI = 4

NOT PRESENT IN STUDY AREA

MIXED SAND AND GRAVEL (SHELL) BEACHES ESI = 5

DESCRIPTION

- These beaches have sediments composed of a mixture of sand and shell.
- There can be large-scale changes in the sediment distribution patterns along the Gulf shore depending upon season, because of the transport of the sand fraction offshore during storms.
- Because of sediment desiccation and mobility on exposed beaches, densities of animals and plants are lower than sand beaches.
- They are uncommon and comprise less than one percent of the shoreline.

PREDICTED OIL BEHAVIOR

- During small spills, oil will be deposited along and above the high-tide swash.
- Large spills will spread across the entire intertidal area.
- Oil penetration into shelly zones may be up to 50 cm; however, in general oil behavior is much like on a sand beach.
- Burial of oil may be deep at and above the high-tide line, where oil tends to persist.
- Oil can be stranded in the coarse sediments on the lower part of the beach, particularly if the oil is weathered or emulsified.

RESPONSE CONSIDERATIONS

- Heavy accumulations of pooled oil from the upper beachface should be removed quickly to prevent penetration into the porous sediments.
- All oiled debris should be removed.
- Sediment removal should be limited as much as possible.
- Mechanical reworking of lightly oiled sediments from the high-tide zone to the upper intertidal zone can be effective along the Gulf shore.
- In-place tilling may be used to reach deeply buried oil layers in the middle zone on exposed beaches, as an alternative to sediment removal.

GRAVEL (SHELL) BEACHES ESI = 6A

NOT PRESENT IN STUDY AREA

EXPOSED RIPRAP STRUCTURES ESI = 6B

DESCRIPTION

- Riprap structures are composed of cobble- to boulder-sized blocks of granite or limestone.
- Riprap structures are placed for shoreline protection and inlet stabilization.
- Attached biota on the riprap can be sparse.
- These structures are highly utilized for shore-based fishing.
- Exposed riprap comprises less than one percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Deep penetration of oil between the boulders is likely.
- Oil adheres readily to the rough rock surfaces.
- If oil is left uncleaned, it may cause chronic leaching until the oil hardens.

RESPONSE CONSIDERATIONS

- When the oil is fresh and liquid, high-pressure spraying and/or water flooding may be effective, making sure to recover all released oil.
- Heavy and weathered oils are more difficult to remove, requiring scrapping and/or hot-water spraying.
- It may be necessary to remove heavily oiled riprap and replace it.

EXPOSED TIDAL FLATS ESI = 7

DESCRIPTION

- Exposed tidal flats are broad intertidal areas composed primarily of sand and minor amounts of shell and mud.
- The presence of sand indicates that tidal or wind-driven currents and waves are strong enough to mobilize the sediments.
- They are usually associated with another shoreline type on the landward side of the flat and are most commonly associated with tidal inlet systems.
- Biological utilization can be very high, with large numbers of infauna, heavy use by birds for roosting and foraging, and use by foraging fish.
- They are also highly utilized for recreational fishing.
- Because of the small tidal range, they are uncommon and comprise less than one percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil does not usually adhere to the surface of exposed tidal flats, but rather moves across the flat and accumulates at the high-tide line.
- Deposition of oil on the flat may occur on a falling tide if concentrations are heavy.
- Oil does not penetrate water-saturated sediments.
- Biological damage may be severe, primarily to infauna, thereby reducing food sources for birds and other predators.

RESPONSE CONSIDERATIONS

- Currents and waves can be very effective in natural removal of the oil.
- Cleanup is very difficult (and possible only during low tides).
- The use of heavy machinery should be restricted to prevent mixing of oil into the sediments.
- On exposed sand flats, oil will be removed naturally from the flat and deposited on the adjacent beaches where cleanup is more feasible.

SHELTERED SOLID MAN-MADE STRUCTURES ESI = 8A

DESCRIPTION

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- Many structures are constructed of concrete, wood, or metal.
- Often there is no exposed beach at low tide, but multiple habitats are indicated if present.
- Most of the structures in bays are designed to protect a single lot, thus their composition, design, and condition are highly variable.
- They can have high recreational use, particularly in public areas.
- Attached animal and plant life can be sparse.
- This shoreline type comprises 9 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil will adhere readily to the rough surface, particularly along the high-tide line, forming a distinct oil band.
- The lower intertidal zone usually stays wet (particularly if algae covered), preventing oil from adhering to the surface.

RESPONSE CONSIDERATIONS

- Cleanup is usually conducted for aesthetic reasons or to prevent leaching of oil.
- Low- to high-pressure spraying at ambient water temperatures is most effective when the oil is fresh.

SHELTERED RIPRAP STRUCTURES ESI = 8B

DESCRIPTION

- Riprap structures are composed of cobble- to boulder-sized blocks of granite or limestone.
- These structures include revetments, seawalls, piers, and docks constructed of impermeable materials such as concrete.
- They are found inside harbors and bays in highly developed areas, sheltered from direct exposure to waves.
- Sheltered riprap structures comprise less than one percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Deep penetration of oil between the boulders is likely.
- Oil adheres readily to the rough rock surfaces.
- If oil is left uncleaned, it may cause chronic leaching until the oil hardens.

RESPONSE CONSIDERATIONS

- High-pressure spraying may be required to remove oil for aesthetic reasons and to prevent leaching of oil from the structure.
- Cleanup crews should make sure to recover all released oil.

SHELTERED SCARPS ESI = 8C

DESCRIPTION

- Sheltered scarps can be composed of clay formed by dredge-spoil deposits in man-made waterways or steep slopes composed of either clay or sand and covered with terrestrial vegetation.
- There may be some fringing marsh along the water's edge; it is not significant to map.
- They comprise 2 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil will not adhere to the wet sediment surface, but could penetrate burrows if present and dry.
- Stranded oil will persist because of low energy setting.

RESPONSE CONSIDERATIONS

- Where the high-tide area is accessible, it may be feasible to manually remove heavy oil accumulations and oiled debris.
- The muddy substrate cannot support heavy equipment, and even foot traffic could disrupt the sediments and mix oil deeper.

SHELTERED TIDAL FLATS ESI = 9A

DESCRIPTION

- Sheltered tidal flats are composed primarily of silt and clay with minor amounts of sand and shell.
- They are present in calm-water habitats, sheltered from major wave activity, and are frequently fronted by marshes.
- They also include wind-tidal flats that are subject to inundation only by wind-generated tides.
- Wave energy is very low, although there may be strong tidal currents on parts of the flat and in channels across the flat.
- The sediments are very soft and cannot support even light foot traffic in many areas.
- There can be large populations of shellfish, worms, and snails.
- They are heavily utilized by birds for feeding and roosting.
- Sheltered tidal flats are very uncommon, comprising less than one percent of the shoreline length.

PREDICTED OIL BEHAVIOR

- Oil does not usually adhere to the surface of sheltered tidal flats, but rather moves across the flat and accumulates at the high-tide line.
- Deposition of oil on the flat may occur on a falling tide if concentrations are heavy.
- Oil will not penetrate the water-saturated sediments, but could penetrate burrows and mud cracked sediments.
- In areas of high suspended sediments, sorption of oil can result in deposition of contaminated sediments on the flats.
- Biological damage may be severe.

RESPONSE CONSIDERATIONS

- These are high-priority areas necessitating the use of spill protection devices to limit oil-spill impact; deflection or sorbent booms and open water skimmers should be used.
- Cleanup of the flat surface is very difficult because of the soft substrate and many methods may be restricted.
- Low-pressure flushing and deployment of sorbents from shallow-draft boats may be helpful.

RIVERINE BANKS WITH GRASSES OR TREES ESI = 9B

DESCRIPTION

- Either low banks with grasses or low eroding banks with trees and tree roots exposed to the water.
- Flooded occasionally by high water.
- These shorelines are generally found in fresh or brackish water localities.
- This shoreline type comprises approximately 1 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- During low water stages there is little impact, with the oil coating a narrow band of sediment at the water level.
- During high water, the oil will cover and coat the grasses and base of the trees.
- May cause loss of the grasses, but the trees should survive unless oil penetrates and persists in the substrate.

RESPONSE CONSIDERATIONS

- Low-pressure flushing of oiled areas is effective in removing moderate to heavy accumulations of oil from along the banks.
- Sorbent and containment boom should be placed on the water side of the cleanup operations to contain and collect oil outflow.
- Low- to high-pressure flushing can be used to remove oil from tree roots and trunks, if deemed necessary in high-use areas.

SALT AND BRACKISH WATER MARSHES ESI = 10A

DESCRIPTION

- Marshes are intertidal wetlands containing emergent, herbaceous vegetation.
- Width of the marsh can vary widely, from a narrow fringe to extensive areas.
- They are relatively sheltered from waves and strong tidal currents.
- Sediments are composed of organic muds except on the margins of barrier islands where sand is abundant.
- Resident flora and fauna are abundant with numerous species and high utilization by birds.
- This is the most common shoreline type, comprising 40 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil adheres readily to marsh vegetation.
- The band of coating will vary widely, depending upon the water level at the time oil slicks are in the vegetation. There may be multiple bands.
- Large slicks will persist through multiple tidal cycles and coat the entire stem from the high-tide line to the base.
- If the vegetation is thick, heavy oil coating will be restricted to the outer fringe, although lighter oils can penetrate deeper, to the limit of tidal influence.
- Medium to heavy oils do not readily adhere to or penetrate the fine sediments, but can pool on the surface or in burrows.
- Light oils can penetrate the top few centimeters of sediment and deeply into burrows and cracks (up to one meter).

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Heavy accumulations of pooled oil can be removed by vacuum, sorbents, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Cleanup activities should be carefully supervised to avoid vegetation damage.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.

FRESHWATER MARSHES (HERBACEOUS VEGETATION) ESI = 10B

DESCRIPTION

- Freshwater marshes are wetlands composed of freshwater herbaceous vegetation.
- They occur upstream of brackish vegetation along major rivers and tributary bayous and creeks; many freshwater marshes within the study area are tidally influenced.
- Those along major channels are exposed to strong currents and boat wakes; inland areas are highly sheltered.
- The sediment substrate is seldom exposed since daily water level changes are low; greater changes result from floods and wind-generated tides.
- Resident flora and fauna are abundant with numerous species, with high utilization by birds.
- They are not common in the study area, comprising less than one percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil adheres readily to marsh vegetation.
- The band of coating will vary widely, depending upon the water level at the time oil slicks are in the vegetation. There may be multiple bands.
- Large slicks will persist through multiple water level changes and coat the entire stem from the high-water line to the base.
- If the vegetation is thick, heavy oil coating will be restricted to the outer fringe, although lighter oils can penetrate to the limit of the marsh.
- Medium to heavy oils do not readily adhere to or penetrate the fine sediments, but can pool on the surface or in burrows.
- Light oils can penetrate the top few centimeters of sediment and deeply into burrows and cracks (up to one meter).

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Heavy accumulations of pooled oil can be removed by vacuum, sorbents, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Cleanup activities should be carefully supervised to avoid vegetation damage.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.

FRESHWATER SWAMPS (WOODY VEGETATION)

ESI = 10C

DESCRIPTION

- Freshwater swamps consist of shrubs and hardwood forested wetlands, essentially flooded forests.
- They are common along major river valleys.
- The sediment tend to be silty clay with large amounts of organic debris.
- They are seasonally flooded, though there are many low, permanently flooded areas.
- Resident flora and fauna are abundant with numerous species.
- Swamps are the second most common shoreline type, comprising 25 percent of the shoreline.

PREDICTED OIL BEHAVIOR

- Oil behavior depends on whether the swamp is flooded or not.
- During floods, most of the oil passes through the forest, coating the vegetation above the water line, which changes levels throughout the flood event.
- Oiled woody vegetation is less sensitive than marshes to oil coating.
- Some oil can be trapped and pooled on the swamp flood plain as water levels drop.
- Penetration into the floodplain soils is usually limited because of high water levels, muddy composition, surface organic debris, and vegetation cover.
- Large amounts of oily debris can remain.
- During dry periods, terrestrial spills flow downhill and accumulate in depressions or reach water bodies.

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Heavy accumulations of pooled oil can be removed by vacuum, manual removal, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Under stagnant water conditions, herding of oil with water spray may be needed to push oil to collection areas.
- Oily debris can be removed where there is access.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.